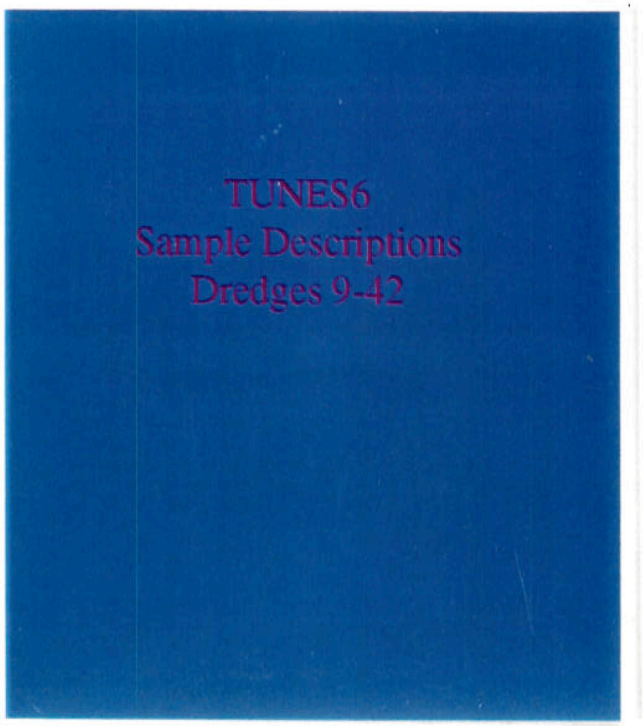

#16

Work Completed

The Tunes VI expedition began on Oct 31 in Kwajalein and ended in Apra/Guam on Dec. 2, 1991 (Figure 1). We acquired detailed bathymetry and geophysics data and dredged 13 seamounts (Table 1). We recovered datable basaltic rocks from at least ten seamounts. Most of these data and samples were obtained in the first half of the cruise, exceeding slightly what we had proposed. However, in the second half of the cruise weather conditions began limiting our performance significantly, with close approaches of five Taifuns. The Taifuns prohibited us from approaching three of our stated targets, and we had to abandon attempts to dredge the last four seamounts surveyed (# 14-17) in Table 1. We spent the remaining time of our cruise running away from the weather, whereby one Taifun, Yuri, paralyzed Apra Harbor, our ending port and the island of Guam for two days.

Table 1

Names, dredge numbers and locations of Western Pacific Seamounts and Guyots studied during Tunes VI.

1.	Wodejebato Seamount / Sylvania	D 9-11	11°55'N/164°45'E	Fig 2
2.	Neen Koiaak	D 12-13	14°23'N/161°02'E	Fig 7
3.	Aean Kan	D 14-15	14°52'N/160°26'E	Fig 8
4.	South Wake	D 16-18	19°32'N/157°54'E	Fig 9
5.	Batiza	D 19-22, 25	20°20'N/156°30'E	Fig 10
6.	Maloney	D 23	20°58'N/157°10'E	Fig 11
7.	Jennings	D 24	20°54'N/156°25'E	Fig 12
8.	Vlinder*	D 26-32	16°58'N/154°18'E	Fig 13
9.	Missy	D 33-35	21°09'N/154°48'E	Fig 15
10.	Golden Dragon Seamount	D 36-37	21°18'N/153°12'E	Fig 14
11.	Bellevue Guyot*	D 38	23°52'N/150°39'E	Fig 16
12.	Alkatraz Guyot*	D 39	24°10'N/150°05'E	Fig 17
13.	Seth Guyot*	D 40-44	23°49'N/148°46'E	Fig 18
14.	Thelma Seamount*		23°28'N/148°34'E	Fig 19
15.	Zelda*		23°00'N/148°33'E	Fig 20
16.	Yuri*		23°13'N/148°52'E	Fig 21
17.	Verne*		23°04'N/148°18'E	Fig 20

Seamount and Guyot names with asterisk indicate informal working names of previously unnamed features.

The approach and departure to most seamounts were optimized for a gravity line. For an initial survey, we defined the summit platform circumference and then the rifts and satellites. The rapid course changes necessary for the tracing of the summit platform edge did not lead to navigational problems due to the nearly complete GPS coverage, allowing us to ignore inertial navigation. Dredging was planned and executed after an initial characterization of the seamount/guyot morphology.

We completed the reduction of bathymetry data. We used our own SeaBeam data on well navigated tracks (shaded in Figures 1-21) and manually interpolated the

contours in areas not covered by our own data. At some seamounts and guyots manual contouring was aided by high resolution bathymetry data published by Smoot (1991; Figures 10-12, and 15). In the latter case, our GPS navigated tracks were used to remove some distortions in published maps (Smoot, 1991) and to bring these maps into a GPS navigation framework. Contours were digitized, and merged with the SeaBeam data file. The base level of seamounts was typically defined on the basis of approach/departure data and DBDB 5 data coverage. All digital data handling and graphics were carried out using the GMT software package (Wessel and Smith, 1992).

We could define the major features of most seamounts or guyots analyzed, the elevation and shape of the summit, the rift zones, satellites and the basal circumference. Minimal surveys were done for seamounts with earlier bathymetric coverage (Batiza, Jennings, Maloney, Missy, Golden Dragon), or seamounts that were surveyed because they were close to our ship track (Alcatraz, Bellevue). Most features were characterized by flat tops, carbonates were dredged for six guyots. Morphologically, most of the guyots of the Northwest Marshalls and the Marcus-Wake groups appear to be non-reef-bearing. Minor rudistid limestone in a Manganese-phosphorite matrix was found "South Wake" Guyot. This was surprising, since the morphological aspects of this guyot are typical of the non-reef bearing type. One other seamount in this group, "Jennings" Guyot, yielded Cretaceous shallow water limestone. The summit morphology of this seamount suggests the presence of a thin reef-bounded platform along its northern side. These finds represent important new constraints on the distribution of Cretaceous shallow water limestone in the western Pacific, since the Wake guyots were thus far considered to be essentially reefless.

Guyot-tops without limestone deposits typically have summit-regions which gently slope from a central high point to a main slope-break, below which the volcano slopes at 12°-20° down to the surrounding sea-floor. Drowned atolls typically have flat summits, the shallowest points of which are found close to the summit edge, where a rim occurs 20-40 m above the summit plateau. Upper slope angles are much steeper, typically in the range of 24°-36°. The base of the carbonate deposits can be observed where the slope becomes abruptly less steep and noticeably more irregular. In one case (Vlinder), a volcanic cone was identified on a summit platform, indicating rejuvenated volcanism.

The other carbonate-bearing guyots in this study are located in a small cluster at the western end of the Marcus-Wake seamounts. Dredges on two of these ("Alcatraz" and "Seth") recovered shallow-water limestone, while a third guyot, "Bellevue", has all the morphological characteristics of a drowned atoll. All three of these guyots have flat tops, and steep, smooth upper slopes extending to great depths, which suggests that the thickness of carbonates on these guyots may be as much as 1000 m.

We recovered a suite of alkalic and transitional basalts from most seamounts, including datable materials on ten. Initial dredge descriptions are summarized in Appendix 1. Despite the high degree of alteration in many of these samples, most of them have abundant unaltered phenocrysts and sufficient material was recovered to generate mineral separates for identifying pristine igneous characteristics. We generally place the highest priority on establishing a reliable age for these rocks, the second priority on the isotopic ratios and general geochemical characterization.

During this cruise, we also sampled and preserved about 100 samples of Mn - crusts that were supplied to J. Hein (USGS Menlo Park). Hein will independently analyze these materials and include them in his studies of Western Pacific Mn crusts,

Work planned and work in progress:

After completing marine data acquisition, rock sampling and description, and initial data reduction, we are now in the position of carrying out geophysical modeling, chemical and isotopic analyses and begin summarizing our field data in publication form.

A. Geophysics

Navigation, and bathymetric data are reduced to about 90%, we have now a gridded bathymetric data set for all seamounts/guyots. Gridded bathymetry provides the basis for our modeling of gravity and magnetics data, as discussed in the proposed work section.

B Geochemistry/Petrology/Geochronology

On the basis of the petrographic characterization of hard rocks, we have begun separation of phenocrysts phases for age dating and isotopic analysis. So far, we have prepared twelve plagioclase, amphibole and nepheline separates for geochronology and radiogenic isotopes and an additional seven clinopyroxenes for radiogenic isotope analysis. In parallel, we are continuing petrographic descriptions and preparation of bulk rock samples for major and trace ele nent analysis, and analysis by electron microprobe. We will also analyze materials from ODP Leg 144, in collaboration with D. Christie (OSU).

C Carbonate Petrology

Limestones will be petrographically analyzed and for dateable microfossils by R. van Waasbergen and collaborators.

Figure Captions

Figure 1

Tunes 06 ship track from Majuro/Marshalls Isl. to Apra/Guam. Boxes indicate detailed maps in Figures 2-5: Wodejebato Figure 2; NW Marshalls in Figure 3; Vlinder Guyot in Figure 5; Western Wakes in Figure 4; and Typhoon Group and Alkatraz/Bellevue in Figure 6.

Figure 2

Tunes VI ship track and ODP Leg 144 holes on Wodejebato Guyot. Sites 875 and 874 were chosen on the basis of terraces identified during Tunes 6. Bathymetry following Bergersen (pers. comm.)

Figure 3

Index map of the NW Marshalls ship track with Neen Koiaak (Figure 7) and Aean Kan (Figure 8).

Figure 4

Index map of the Tunes VI ship track through the Western Wakes including South Wake (Figure 9), Batiza Guyot (Figure 10 a), West Batiza Guyot (Figure 10b), Maloney Guyot (Figure 11); Jennings Guyot (Figure 12), Golden Dragon (Figure 14), Missy Guyot (Figure 15)

Figure 5

Index map of the Tunes VI ship track in vicinity of Vlinder Guyot (Figure 13)

Figure 6

Ship track index map of Typhoon Group and Alkatraz/Bellevue guyots

Figure 7

Bathymetric map of Neen Koiaak with location of Dredges 12 and 13

Figure 8

Bathymetric map of Aean Kaan with location of Dredge 15

Figure 9

Bathymetric map of South Wake with location of Dredges 16-18

Figure 10

a, Bathymetric map of Batiza Guyot with location of Dredges 19, 21, and 22
b, Bathymetric map of West Batiza Guyot with location of Dredge 25;
Bathymetry not covered by Tunes VI tracks is adapted from Smoot (1990)

Figure 11

Bathymetric map of Maloney Guyot with location of Dredge 23, bathymetry not covered by Tunes VI tracks is adapted from Smoot (1990)

Figure 12

Bathymetric map of Jennings Guyot with location of Dredge 24, bathymetry not covered by Tunes VI tracks is adapted from Smoot (1990)

Figure 13

Bathymetric map of Vlinder Guyot with locations of Dredges 27-29 on the main guyot, and Dredges 30-31 on Oma Vlinder

Figure 14

Bathymetric map of Golden Dragon with locations of Dredge 36 and 37

Figure 15

Bathymetric map of Missy with locations of Dredges 33-35, bathymetry not covered by Tunes VI tracks is adapted from Smoot (1990).

Figure 16

Bathymetric map of Bellevue with location of Dredge 39

Figure 17

Bathymetric map of Alcatraz with location of Dredge 38

Figure 18

Bathymetric map of Seth Guyot with locations of Dredges 40, 41, 42, and 44.

Figure 19

Bathymetric map of Thelma Seamount

Figure 20

Bathymetric map of Verne and Zelda

Figure 21

Bathymetric map of Yuri Seamount

Appendix 1

Dredge Summaries of Tunes VI

Progress Report

NSF OCE 91-02183

"The Cretaceous History of the South Pacific Thermal and Isotopic Anomaly: The Magellan Seamounts"

by Hubert Staudigel

Institute for Geophysics and Planetary Physics

Scripps Institution of Oceanography

To study the long term history of the South Pacific Isotope and Thermal anomaly (SOPITA), we proposed to characterize nine Seamounts or Guyots in the Magellan and Marshals seamount groups in the western Pacific. During the first nine months of the funding period, we have completed a six week field expedition whereby we surveyed and sampled eight seamounts in detail, four for reconnaissance, and we surveyed four additional seamounts/guyots. During our shore based investigation, we have completed the bathymetry data reduction and we began reducing the underway geophysics data. All dredges have been petrographically described in detail, and 150 samples have been selected for initial study. Amongst those samples we have studied about 50 petrographically and prepared twelve mineral separates dating and isotopic analysis.

The remaining funding period of this fiscal year and the next years funding will be devoted to complete petrography, major and trace element and isotopic analysis, and geophysics data reduction. Our efforts go hand-in-had with publication of our results, beginning with an informal poster presentation at the 1991 Fall AGU meeting, publications are in preparation on the morphology and petrology, and the carbonate caps of these features.

TUNES dredge locations that are not in the cruise report

Dredge NO	Start lat [N]	Start long [E]	End lat [N]	End long [E]
D13	14° 16.7'	160° 53.8'	14° 17.4'	160o 55.8'
Neen-Koiaak Guyot, on Southern rift of same amphitheatre as dredge 12; 3200m-2000m				
D23	21° 03.4'	157° 09.2'	21° 03.0'	157° 09.6'
NW slope Maloney Guyot; 2400m-2200m				
D25	20° 26.9'	155° 55.4'	20° 27.0'	155° 55.7'
W. Batiza; 2300-2100m				
D27	16° 59.4'	154° 00.2'	16° 59.4'	154° 01.5'
Small cone west side of Vlinder guyot in Magellans smts; 3100-2900m				
D28	17° 02.2'	154° 043.7'	17° 02.3'	154° 04.3'
W flank of Vlinder Guyot; 3200-2200m				
D29	17° 07.3'	154° 19.9'	17° 07.4'	154° 20.2'
SE corner of landslide scarp on northern slope of Vlinder Guyot; 2300-1700m				

Christi: I finally got the Lats-, Longs, + water depths for the missing data —

Jim

TUNES dredge locations that are not in the cruise report

Dredge NO	Start lat [N]	Start long [E]	End lat [N]	End long [E]
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D23	21° 03.4'	157° 09.2'	21° 03.0'	157° 09.6'
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D27	16° 59.4'	154° 00.2'	16° 59.4'	154° 01.5'
Small cone west side of Vlinder guyot in Magellans smts; 3100-2900m				
D28	17° 02.2'	154° 043.7'	17° 02.3'	154° 04.3'
W flank of Vlinder Guyot; 3200-2200m				
D29	17° 07.3'	154° 19.9'	17° 07.4'	154° 20.2'
SE corner of landslide scarp on northern slope of Vlinder Guyot; 2300-1700m				

TUNES dredge locations that are not in the cruise report

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D29	17° 07.3'	154° 19.9'	17° 07.4'	154° 20.2'
SE corner of landslide scarp on northern slope of Vlinder Guyot; 2300-1700m				

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Branch of Isotope Geology
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Menlo Park, CA 94025

and Robert van Waasbergen, SIO

12/27/91

Dear Malcolm and Robert,

enclosed find a printout of a slightly edited version of our Dredge Summaries and the straight printouts of the rock descriptions. Please compare the Dredge Summaries with your notes, and edit + complete this set and send it back to me for final editing. If you have additional rock descriptions, please pass them on to me so I can include them in the final data set. Some of the rock descriptions were eithern not entered into the computer, or I do not have a copy of the corresponding spreadsheets. Do you have a copy of those?

Once you sent me your comments, I will compile a final list and send you a digital and a hardcopy.

As an initial set, I have ordered about 50 TS. I will let you know what we will find out.

Cheers

Hubert Staudigel 619-534-4242

Please Note my new address (intermittent until, and after May 31 1992:

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De Boelelaan 1085, 1081 HV Amsterdam, Holland